

Application No. 10/554,713
Response to Office Action dated October 28, 2008
Amendment dated January 27, 2009

AMENDMENTS TO THE SPECIFICATION

Please replace paragraph 0044 of the published application with the following replacement paragraph:

-- The actuation means 24 is formed by an electromagnet coil arrangement [[24a]], a soft magnetic magnet yoke arrangement 24b cooperating with same, as well as a soft magnetic magnet armature arrangement 24c cooperating with same. The soft magnetic magnet yoke arrangement 24b is formed by two dish halves 24b' and 24b" with recesses 26a, 26b, which are joined approximately at the height of the section line II-II. The recesses 26a, 26b in the embodiment according to FIG. 1 have the longitudinal extension in the plan view as shown in FIGS. 4 and 5 and are defined by pole lands [[25a,]] 25b which are also approximately trapezoidal or parallelogram-shaped. In the recesses 26a, 26b one electromagnet coil arrangement 24a' and 24a" each is accommodated which terminates flush with the respective faces 27a, 27b of the dish halves 24b' and 24b". --

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Please replace paragraph 0046 of the published application with the following replacement paragraph:

-- In the arrangement shown in FIG. 1 the electromagnet coil arrangements or the magnet yoke arrangements, respectively, have the configuration shown in FIG. 4, wherein the pole lands [[25a,]] 25b have an essentially quadrangular shape and are arranged adjacent to one another under the formation of spaces for accommodating the electromagnet coil arrangements 24a', 24a". The pole lands [[25a,]] 25b are preferably arranged parallel to one another. Here, the magnet yoke arrangement may consist of an integral soft iron from which the pole lands or the spaces, respectively, are formed. Gaps in the form of slots or elongated holes may be formed into such an integral soft iron formed part, which are filled with an electrically insulating material. It is, however, also possible to make the magnet yoke arrangement as a formed part from sintered iron powder or to assemble and adhesively join it, if required, from several individual pieces which are insulated against one another. --

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Please replace paragraph 0049 of the published application with the following replacement paragraph:

-- From the above it will be apparent that the electromagnet coil arrangement [[24a]] and the radially oriented segments 25 of the soft magnetic armature disk 24c may be oriented essentially at right angles to one another. It is understood that this may be realised either in the above described form with the radially oriented segments 25 of the armature arrangement 24b and a helical electromagnet coil arrangement [[24a]] or magnet yoke arrangement 24b, respectively, or vice versa. But also with armature parts and a star-shaped electromagnet coil arrangement. --

Please replace paragraph 0050 of the published application with the following replacement paragraph:

-- The magnet armature arrangement 24c is a circular iron-containing disk the shape of which will be described in detail further below. The electromagnet coil arrangement [[24a]] and the magnet armature arrangement 24c overlap in the radial direction with respect to the centre axis (M). As shown in FIG. 1 the electromagnet coil arrangement [[24a]] has a smaller outer diameter than the armature disk 24c so that the magnetic flux from the electromagnet coil arrangement [[24a]] enters the armature disk 24c under virtually insignificant stray losses. Thereby a particularly efficient magnetic circuit is realised which allows very short valve opening/closing times as well as high holding forces. --

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Please replace paragraph 0052 of the published application with the following replacement paragraph:

-- As illustrated in FIG. 1 the armature disk 24c is rigidly connected with the actuation rod 22 and accommodated in an armature space 34 which is defined by the dish halves 24b' and 24b" of the magnet yoke arrangement 24b and guided for movement in the longitudinal direction in the pipe 17 along the centre axis M. The armature disk 24c with the actuation rod 22 is biased by a helical spring 40 which is arranged coaxially to the centre axis M, so that the valve member 20a which is located at the end of the actuation rod 22 is seated fluid tight in the valve seat 20b, i.e. that it is urged into its closed position. Upon current supply to one of the coils (e.g. 24a') of the electromagnet coil arrangement [[24a]], a low eddy current magnetic field is induced in the magnet yoke arrangement 24b, which draws the armature disk 24c with the actuation rod 22 towards the relevant dish half 24b' in which the current-carrying coil is located. Thereby the valve member 20a moves off the valve seat 20b into its open position. Upon current supply of the other coil (e.g. 24a") of the electromagnet coil arrangement [[24a]], the valve member 20a moves in the relevant other direction towards the valve seat 20b into its closed position. A helical coil 40 at the end of the actuation rod 22 far from the valve member 20a acts on same and maintains the valve member 20a with the currentless electromagnet coil arrangement [[24a]] in its closed position. --

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Please replace paragraph 0053 of the published application with the following replacement paragraph:

-- Another embodiment of the invention which is not shown in detail consists in coupling several (two or more) armature disks 24c with the valve member 20a via the actuation rod 22, onto which a coil yoke arrangement acts from one or from both sides. Moreover, the coil arrangement [[24a]] at both sides of the soft magnetic magnet armature arrangement 24 may be configured as a multiple-part component. In this case, two or more electromagnet coil arrangements 24a', 24a" are provided which terminate essentially flush with the respective faces 27a, 27b of the dish halves 24b' and 24b". This embodiment though of the same installation volume may have an increased magnetic field density and therefore an increased valve member holding force and valve member actuation speed. Through the individual coils on one side (above or below, respectively) of the respective magnet armature arrangement 24c a reverse current is alternately flowing. The yoke iron between the individual coils [[24a]] of one side may be formed here by iron plates which are insulated against each other. --

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Please replace paragraph 0055 of the published application with the following replacement paragraph:

-- In the embodiment of the magnet yoke or the magnet coils, respectively, according to FIG. 4 each individual pole land is surrounded by a separate winding. For the sake of clarity, not all the pole lands are illustrated with electromagnet coil arrangements in FIG. 4. All electromagnet coil arrangements 24a' and 24a" are either wound in the opposite sense and supplied with equidirectional current, or in the case of equidirectional windings are supplied with reverse current in order to guide a reverse electrical current each at opposite flanks 25a', 25a" of the pole lands [[25a.]] 25b. --

Please replace paragraph 0056 of the published application with the following replacement paragraph:

-- Alternatively, it is also possible to configure the electromagnet coil arrangement as shown in FIG. 5, wherein one (or several) windings is (are) inserted in meander fashion into the recesses 26a, 26b between the pole lands [[25a.]] 25b of the magnet yoke arrangement. In this case, too, reverse electrical current is guided by the opposite flanks 25a', 25a" of each of the pole lands [[25a.]] 25b. As can be seen, the pole lands [[25a.]] 25b (and the recesses 26a, 26b, too) are essentially asymmetrically arranged with respect to the centre axis M of the fuel injection valve, with at least one electromagnet coil arrangement 24a', 24a" partially enclosing non-circular pole lands in such a manner that a reverse electrical current is guided by at their flanks. --

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Please replace paragraph 0057 of the published application with the following replacement paragraph:

-- The embodiment of an electromagnet coil arrangement [[24a]] illustrated in FIGS. 6 and 7 is manufactured as an integrated arrangement with the soft magnetic magnet yoke arrangement which cooperates with it. For this purpose, an elongated yoke plate 50 which contains soft iron is surrounded on either side with a conductor strip 52 by bending same about a longitudinal edge 50' of the yoke plate 50, which in the finished condition will be located in the interior. Adjacent to the conductor strip 52 a sheet metal band 54 containing soft iron is arranged which has exactly the same thickness as the conductor strip 52 and is also bent about the longitudinal edge 50' of the yoke plate 50, which in the finished condition will be located in the interior. The sheet metal band 54 arranged adjacent to the conductor strip 52 serves to form the back of the magnet yoke together with the portion of the yoke plate 50 with which it is in plane contact in the finished condition. The conductor strip 52 protrudes beyond the lateral longitudinal edge 50" of the yoke plate 50, which in the finished condition is located at the outside, at both ends for electric contact making. Then a second layer of an elongated yoke plate 56 which contains soft iron is placed against it so that a laminated structure consisting of the first yoke plate 50, the conductor strip 52, and the sheet metal band 54, as well as of the second yoke plate 56 is generated. This laminated structure is then helically rolled up in the fashion as shown in FIG. 6 in order to obtain the overall structure consisting of a coil and of a yoke. After the helical rolling up the first and second yoke plate 50, 56 are arranged close to one another and the

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overall structure is a cylindrical wound body. It is understood that the conductor strip 52 is electrically insulated against the soft iron part 50, 54, 56. --